Attorney Docket No. 200335-0037

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Appln. of Toshihide ITO et al.

Application No. 09/671,084

Filed: September 27, 2000

For: "Sn-Ag-Cu SOLDER AND SURFACE TREATMENT AND PARTS MOUNTING METHODS USING THE SAME""

I, Carol A. Graves, hereby certify that this correspondence is being deposited with the US Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date of my signature.

Carol A. Graves
Signature

Nov. 26, 2003
Date of Signature

Art Unit: 1742

Examiner: S. Ip

Confirmation No. 6569

DECLARATION UNDER 37 CFR § 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Yoshinobu Ishiguro hereby declares as follows:

1. I received a degree from the Aichi Institute of Technology, Department of Applied Chemistry.

2. I have been in charge of the development of various different solders for the assignee of the present application, Solder Coat Co., Ltd., for approximately seven years.

3. During the period October 1 to October 10, 2003, I conducted an experiment as described below at a laboratory of Solder Coat Co., Ltd. This experiment was conducted in order to examine the properties or characteristics of the solders of claims 3 and 6 of WO 9834755.

4. Samples 1 to 72, referred to below, were prepared as follows: First, a Sn alloy containing 6 wt.% Ni (i.e., Sn-6Ni), a Sn alloy containing 3 wt.% Fe (i.e., Sn-3Fe), and a Sn alloy containing 1 wt.% Co (i.e., Sn-1Co) were produced using a high-frequency electrical induction furnace. Then, the necessary amounts of the Sn, Ag, Cu and Sn alloys thus

produced were measured and thereafter melted by heat in a magnetic crucible or a stainless container.

5. The following combinations were examined in the samples:

Ag: 3	Cu: 0.5
Ag: 3	Cu: 4
Ag: 3.5	Cu: 1
Ag: 3.5	Cu: 2.5
Ag: 4	Cu: 0.5
Ag: 4	Cu: 1
Ag: 5.5	Cu: 2.5
Ag: 7.7	Cu: 1
Ag: 7.7	Cu: 4

Fe: 0.1, 0.5
Ni: 0.1, 0.5
Co: 0.1, 0.5
Fe + Ni + Co: 0.1 + 0.1 + 0.1
Fe + Ni + Co: 0.3 + 0.3 + 0.3

Accordingly, 72 samples were examined in total, as to the liquidus and solidus temperatures, cooper dissolution rate, and viscosity. In these tests, the solidum temperature was set at 217°C for all of samples 1-72, in accordance with claim 1 of WO 9834755.

6. The solidus temperatures of the samples were measured by using approximately 10 mg of each of the samples clamped in the cell of a differential scanning calorimeter (DSC) "TA-60WS" (manufactured by Shimadzu Corporation). Thereafter, a curve showing the relationship between the output (mV) of the DSC and the cell temperature (°C) was written on a chart by the DSC. From the curve thus obtained, the solidus temperature was read. The solidus temperature was defined as a temperature determined by the intersection of two tangential lines formed at a bending point of the curve.

7. The liquidus temperature of the samples were measured by taking approximately 50 g of each of the samples and placing them in a magnetic crucible. Thereafter, the crucible was heated to a temperature ranging from 300°C to 450°C with an electrical furnace "GB-2" (manufactured by Taika Denki Co., Ltd.) termed the "mantle

heater," thereby melting the sample in the crucible. Subsequently, the sample was gradually cooled in the atmospheric air, where the temperature change of the sample was recorded on a chart with a recorder using a thermocouple. From the curve thus obtained on the chart, the liquidus temperature was read. The temperature at which the curve was bent was defined as the liquidus temperature.

8. The copper dissolution rate of each of the samples was determined by taking approximately 50 g of each of the samples and placing them in a magnetic crucible. Thereafter, the crucible was heated to a temperature of 250°C with an electrical furnace "GB-2" (manufactured by Taika Denki Co., Ltd.) termed the "mantle heater," thereby melting the sample in the crucible. The temperature of the furnace was controlled with a voltage adjuster "SK-105" (manufactured by Toshiba) termed the "SLIDAC." Subsequently, a copper (Cu) wire with a diameter of 0.6 mm was dipped into the sample thus melted until the wire entirely disappeared. The time from the dipping of the wire to the disappearance thereof was measured. A ratio of the copper wire diameter (μm) to its disappearance time (sec) was defined as the copper dissolution rate.

9. The viscosity of each of the samples was measured by heating each of the samples in a measurement cup to a temperature of 250°C, thereby melting the sample in the cup. Then, the viscosity of the sample thus melted was measured at 250°C with a "VISCOTESTER VT-04" (produced by Rion Co. Ltd.).

10. In our tests, in addition to Ni and Fe, Co (cobalt) was used as a like-acting element thereof.

11. The results obtained my experiments are reported in Exhibit A.

12. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: November 25th, 2003

Yoshinobu Ishiguro
YOSHINOBU ISHIGURO

TEST DATA

Sample No.	Sn	Ag	Cu	Fe	Ni	Co	SOLIDUS TEMP. (°C)	LIQUIDUS TEMP. (°C)	COPPER DISSOLUTION RATE (μm/sec)	VISCOSITY (cP)
1	95.4	3	0.5	0.1			217	219	0.051	1.7
2	96	3	0.5	0.6			217	219	0.032	1.8
3	96.4	3	0.5		0.1		217	219	0.072	1.7
4	96	3	0.5		0.5		217	218	0.052	1.7
5	96.4	3	0.5			0.1	217	220	0.062	1.7
6	96	3	0.5			0.5	217	220	0.031	1.7
7	96.2	3	0.5	0.1	0.1	0.1	217	218	0.052	1.8
8	95.8	3	0.5	0.3	0.3	0.3	217	218	0.052	1.8
9	92.9	3	4	0.1			217	371	Solder was not melted partially	-
10	92.5	3	4	0.5			217	425	Solder was not melted partially	-
11	92.9	3	4		0.1		217	360	Solder was not melted partially	-
12	92.5	3	4		0.5		217	432	Solder was not melted partially	-
13	92.9	3	4			0.1	217	361	Solder was not melted partially	-
14	92.5	3	4			0.5	217	428	Solder was not melted partially	-
15	92.7	3	4	0.1	0.1	0.1	217	361	Solder was not melted partially	-
16	92.1	3	4	0.3	0.3	0.3	217	431	Solder was not melted partially	-
17	95.4	3.5	1	0.1			217	235	0.095	3.3
18	95	3.5	1	0.5			217	292	0.052	3.5
19	95.4	3.5	1		0.1		217	218	0.080	1.9
20	95	3.5	1		0.5		217	278	0.068	2.7
21	95.4	3.5	1			0.1	217	222	0.08	2.1
22	95	3.5	1			0.5	217	284	0.051	2.6
23	95.2	3.5	1	0.1	0.1	0.1	217	224	0.045	2.2
24	94.6	3.5	1	0.3	0.3	0.3	217	294	0.021	2.8
25	93.9	3.5	2.5	0.1			217	335	Solder was not melted partially	-
26	93.5	3.5	2.5	0.5			217	392	Solder was not melted partially	-
27	93.9	3.5	2.5		0.1		217	320	Solder was not melted partially	-
28	93.5	3.5	2.5		0.5		217	381	Solder was not melted partially	-
29	93.9	3.5	2.5			0.1	217	315	Solder was not melted partially	-
30	93.5	3.5	2.5			0.5	217	381	Solder was not melted partially	-
31	93.7	3.5	2.5	0.1	0.1	0.1	217	305	Solder was not melted partially	-
32	93.1	3.5	2.5	0.3	0.3	0.3	217	386	Solder was not melted partially	-
33	95.4	4	0.5	0.1			217	218	0.15	1.7
34	95	4	0.5	0.5			217	286	0.021	2.7
35	95.4	4	0.5		0.1		217	218	0.21	1.8
36	95	4	0.5		0.5		217	276	0.039	2.6
37	95.4	4	0.5			0.1	217	219	0.25	1.7
38	95	4	0.5			0.5	217	294	0.042	2.8
39	95.2	4	0.5	0.1	0.1	0.1	217	218	0.095	1.7
40	94.6	4	0.5	0.3	0.3	0.3	217	305	0.031	2.7

41	94.9	4	1	0.1			217	218	0.041	1.9
42	94.5	4	1	0.5			217	294	0.021	2.8
43	94.9	4	1		0.1		217	218	0.051	1.7
44	94.5	4	1		0.5		217	282	0.025	2.8
45	94.9	4	1			0.1	217	219	0.045	1.9
46	94.5	4	1			0.5	217	276	0.021	2.3
47	94.7	4	1	0.1	0.1	0.1	217	225	0.051	2.1
48	94.1	4	1	0.3	0.3	0.3	217	263	0.021	2.8
49	91.9	5.5	2.5	0.1			217	336	Solder was not melted partially	-
50	91.5	5.5	2.5	0.5			217	392	Solder was not melted partially	-
51	91.9	5.5	2.5		0.1		217	333	Solder was not melted partially	-
52	91.5	5.5	2.5		0.5		217	372	Solder was not melted partially	-
53	91.9	5.5	2.5			0.1	217	341	Solder was not melted partially	-
54	91.5	5.5	2.5			0.5	217	398	Solder was not melted partially	-
55	91.7	5.5	2.5	0.1	0.1	0.1	217	321	Solder was not melted partially	-
56	91.1	5.5	2.5	0.3	0.3	0.3	217	384	Solder was not melted partially	-
57	91.2	7.7	1	0.1			217	259	Solder was not melted partially	-
58	90.8	7.7	1	0.5			217	384	Solder was not melted partially	-
59	91.2	7.7	1		0.1		217	288	Solder was not melted partially	-
60	90.8	7.7	1		0.5		217	350	Solder was not melted partially	-
61	91.2	7.7	1			0.1	217	286	Solder was not melted partially	-
62	90.8	7.7	1			0.5	217	361	Solder was not melted partially	-
63	91	7.7	1	0.1	0.1	0.1	217	294	Solder was not melted partially	-
64	90.4	7.7	1	0.3	0.3	0.3	217	384	Solder was not melted partially	-
65	88.2	7.7	4	0.1			217	364	Solder was not melted partially	-
66	87.9	7.7	4	0.5			217	423	Solder was not melted partially	-
67	88.2	7.7	4		0.1		217	353	Solder was not melted partially	-
68	87.8	7.7	4		0.5		217	412	Solder was not melted partially	-
69	88.2	7.7	4			0.1	217	381	Solder was not melted partially	-
70	87.8	7.7	4			0.5	217	426	Solder was not melted partially	-
71	88	7.7	4	0.1	0.1	0.1	217	353	Solder was not melted partially	-
72	87.4	7.7	4	0.3	0.3	0.3	217	425	Solder was not melted partially	-